WHAT IS CLAIMED IS:

1. A method for calculating the resistivity of an ohmic material from voltage data gathered from a matrix of nodes arranged on the ohmic material by iteratively imposing a known current to the matrix and measuring voltage at the nodes, each said iteration of imposing a known current resulting in a set of measured voltages, said measured voltages including error *E*, said method comprising the steps of:

preparing a data set from said measured voltages, said data set comprising voltage drops Δu between nodes;

applying said voltage drops Δu as known variable inputs to an equation that models the ohmic material in two dimensions according to physical laws, said equation also including terms representative of a plurality of unknown resistivities and having a solution equal to zero if said equation contains accurate values of said unknown resistivities and no error *E* is present;

selecting an acceptable value for *E*; and

regularizing said equation to stabilize a value of said unknown resistivities calculated using said equation,

wherein said step of regularizing comprises:

adding a regularization term to said equation, said regularization term comprising a selected regularization constant γ multiplied by a third level error minimization term; and

incorporating said equation and said third level error minimization term into a least squares minimization model and using computer-based numerical methods to solve for values of resistivity that result in a global solution to the least squares minimization model below said acceptable value of *E*.

2. The method of claim 1, wherein said equation applies Kirchoff's law to a selected closed rectangular curve CC surrounding at least one node, said equation comprising:

$$J_{net}(u) = \oint_C i(s)dn - S_C = \oint_C \frac{1}{\rho_r}\left(\frac{du}{ds_n}\right)_r ds - S_C = 0$$

where r is any point on CC at arc length s, $i(s)$ is the current at arc length s on CC flowing in the direction of the outer normal n to CC, S_C is the sum of all current source/sinks within CC, du/ds_n is the voltage gradient normal to the curve at point r, and ρ_r is the sheet resistivity at r.

3. The method of claim 1, wherein said acceptable value for E is identical with the error in voltage measurement.

4. The method of claim 1, wherein said equation is used to evaluate all possible curves CC selected to include each of the four internal corner nodes of the matrix.

5. The method of claim 1, wherein said regularization constant γ is determined so that all terms in the error have equal accuracy.

6. The method of claim 1, wherein said third level error minimization term models said resistivity as a local parabola extending through four adjacent nodes and said third level error minimization term comprises an estimate of a third derivative of said parabola.

7. The method of claim 6, wherein said estimate is defined by the equation:

$$\frac{-\rho_{x_1} + 3\rho_{x_2} - 3\rho_{x_3} + \rho_{x_4}}{\Delta x^3} \approx \nabla_x^3 \rho_x$$

where x_1, x_2, x_3, x_4 are four equally spaced nodes parallel to an x or y axis of the matrix Δx is the distance between nodes and ρ_x is the unknown resistivity.

8. The method of claim 1, wherein said regularization term comprises a second level error minimization term requiring less data than said third level error minimization term and said step of regularizing further comprises:

substituting said second level error minimization term for said third level error minimization term when there is insufficient data for said third level error minimization term.

9. The method of claim 8, wherein said second level error minimization term models said resistivity as piecewise straight lines extending through three adjacent nodes and said second level error minimization term comprises an estimate of a second derivative of said straight lines.

10. The method of claim 9, wherein said second level error minimization term is defined by the equation:

$$\frac{\rho_{x_1} - 2\rho_{x_2} + \rho_{x_3}}{\Delta x^2} \approx \nabla_x^2 \rho_x$$

where x_1, x_2, x_3 are three equidistantly spaced points parallel to the x or y axis, Δx is the distance between nodes and ρ_x is the unknown resistivity.

11. A computerized method for regularizing an optimization of a sheet resistivity calculation in an on-line combustion vessel monitoring system, said method comprising the steps of:

adding a regularization term to the calculation prior to optimization, said regularization term comprising:

a regularization constant γ multiplied by a third level error minimization term, said third level error minimization term models said sheet resistivity as a parabola extending through four adjacent nodes of a measurement matrix and said third level error minimization term comprises an estimate of a third derivative of said parabola.

12. The method of claim 11, wherein said estimate is defined by the equation:

$$\frac{-\rho_{x_1} + 3\rho_{x_2} - 3\rho_{x_3} + \rho_{x_4}}{\Delta x^3} \approx \nabla_x^3 \rho_x$$

where x_1, x_2, x_3, x_4 are four equally spaced nodes parallel to an x or y axis of the matrix Δx is the distance between nodes and ρ_x is the unknown sheet resistivity.

13. The method of claim 11, wherein said regularization term comprises a second level error minimization term requiring less data than said third level error minimization term and said step of adding further comprises:

substituting said second level error minimization term for said third level error minimization term when there is insufficient data for said third level error minimization term but sufficient data for said second level error minimization term.

14. The method of claim 13, wherein said second level error minimization term models said sheet resistivity as a straight line extending through three adjacent nodes and said second level error minimization term comprises a second estimate of a second derivative of said line.

15. The method of claim 14, wherein said second level error minimization term is defined by the equation:

$$\frac{\rho_{x_1} - 2\rho_{x_2} + \rho_{x_3}}{\Delta x^2} \approx \nabla_x^2 \rho_x$$

where x_1, x_2, x_3 are three equidistantly spaced points parallel to the x or y axis, Δx is the distance between nodes and ρ_x is the unknown resistivity.

16. A method for evaluating data representing the electrical characteristics of a combustion vessel, the combustion vessel being operable to combust a fuel, comprising:

preparing a data set based on voltage data gathered from a matrix of nodes arranged on an ohmic material of the combustion vessel including calculating the resistivity of the ohmic material by iteratively imposing a known current to the matrix and measuring voltage at the nodes, each said iteration of imposing a known current resulting in a set of measured voltages, said measured voltages including error *E*, said data set comprising voltage drops Δu between nodes;

applying said voltage drops Δu as known variable inputs to an ohmic material model which takes into account a plurality of unknown resistivities;

selecting an acceptable value for *E*; and

regularizing said model to stabilize a value of said unknown resistivities calculated using said model.

17. A method for evaluating data representing the electrical characteristics of a combustion vessel according to claim 16 wherein the ohmic material model has a solution equal to zero in the event that said model contains accurate values of said unknown resistivities and no error E is present and said step of regularizing includes adding a regularization term to said equation, said regularization term comprising a selected regularization constant γ multiplied by a third level error minimization term and incorporating said equation and said third level error minimization term into a least squares minimization model and using computer-based numerical methods to solve for values of resistivity that result in a global solution to the least squares minimization model below said acceptable value of E.